

CLAIMS:

1. A method of adjusting a group delay adjusting circuit comprising:

5 applying a capacitive control signal to adjust a first variable capacitance;

adjusting the first variable capacitance by applying the capacitive control signal to the first variable capacitance such that the capacitance of the group delay adjusting circuit is adjusted;

10 applying an inductive control signal to a second variable capacitance; and

adjusting the second variable capacitance by applying the inductive control signal to the second variable capacitance of a virtual inductor such that the inductance
15 of the group delay adjusting circuit is adjusted.

2. The method of claim 1, further comprising the step of applying a signal to the group delay adjusting circuit prior to the step of applying a capacitive control signal.

20 3. The method of claim 2, further comprising the step of measuring a group delay of the signal prior to the step of adjusting the first variable capacitance.

4. A method of adjusting a group delay adjusting circuit comprising:

25 applying a capacitate control signal to adjust a first variable capacitance;

adjusting the first variable capacitance by applying
conjunctional positive capacitive control signal to the
first variable capacitance;

5 applying an inductive control signal to a second
variable capacitance; and

adjusting the second variable capacitance by applying
a conjunctional positive inductive control signal to the
second variable capacitance.

5. The method of claim 4, further comprising the
10 step of applying a signal to the group delay adjusting
circuit prior to the step of applying a capacitive control
signal.

6. The method of claim 5, further comprising the
step of measuring a group delay of the signal prior to the
15 step of adjusting the first variable capacitance.

7. A group delay adjusting circuit, comprising:
a transmission line having an input and an output; and
a stub matching structure including a virtual inductor
having a first terminal coupled to the transmission line
20 and a second terminal coupled to ground, and including a
first delay adjust signal input, a second delay adjust
signal input and a DC bias input;

whereby a group delay of a signal envelope coupled to
the input of the transmission line is adjusted at the
25 output of the transmission line, by coupling a first
variable voltage to the first delay adjust signal input,
coupling a second variable voltage to the second delay

adjust signal input, and coupling a DC bias voltage to the DC bias input.

8. The group delay adjusting circuit of claim 7,
wherein the transmission line is a microstrip transmission
5 line.

9. The group delay adjusting circuit of claim 7,
wherein the transmission line is a stripline transmission
line.

10. The group delay adjusting circuit of claim 7,
10 wherein the transmission line length is arbitrary.

11. The group delay adjusting circuit of claim 10,
wherein the virtual inductor includes a quarter wave
transmission line having a first terminal coupled to the
transmission line and a second terminal coupled to a first
15 terminal of a variable capacitor, and having a second
terminal of the variable capacitor coupled to ground.

12. The group delay adjusting circuit of claim 7,
wherein the first delay adjust signal input and the second
delay adjust signal are responsive to varying voltages.

20 13. A group delay adjusting circuit comprising:
an electronically adjustable variable capacitance
having its capacitance adjusted by a first delay adjust
signal; and
an electronically variable virtual inductor having its
25 inductance adjusted by a second delay adjust signal,

coupled in parallel to the electronically variable capacitance at a node;

whereby a signal envelope having a group delay applied to the node is adjusted by the capacitance and inductance
5 such that the group delay is adjusted.

14. The group delay adjusting circuit of claim 13, wherein the electronically variable capacitance comprises a first terminal coupled to a first terminal of the electronically variable virtual inductor, and a second
10 terminal coupled to ground.

15. The group delay adjusting circuit of claim 13, wherein the electronically variable virtual inductor comprises a first terminal coupled to a first terminal of the electronically variable capacitor, and a second
15 terminal coupled to ground.

16. The group delay adjusting circuit of claim 13, further comprising a transmission line coupled to the electronically variable virtual inductor and the electronically adjustable variable capacitor at the node.

20 17. The group delay adjusting circuit of claim 13, further comprising a capacitive control input coupled to a first delay adjust voltage signal.

18. The group delay adjusting circuit of claim 13, further comprising an inductive control input coupled to a
25 second delay adjust voltage signal.

19. A group delay adjusting circuit comprising:
a means for providing an electronically adjustable
variable capacitance; and

a means for providing an electronically variable
5 inductance coupled in parallel to the means for providing
an electronically adjustable capacitance;

whereby the parallel combination includes a first
signal node coupled to a signal, and a second ground node
coupled to a ground potential;

10 whereby a signal envelope having a group delay applied
to the node is adjusted by the electronically adjustable
variable capacitance and the electronically adjustable
variable inductance such that the group delay is adjusted.

20. A method of providing group delay adjustment
15 comprising:

adjusting a first parallel variable shunt capacitance
having a first terminal and a second terminal coupled to a
ground;

adjusting a second variable shunt capacitance; and
20 electrically rotating the second variable shunt
capacitance to a variable inductance by coupling the
variable shunt capacitance to a first terminal of a series
transmission line having an electrical length of a quarter
wavelength at a frequency of operation, in which a second
25 terminal of the series transmission line is coupled to the
first terminal of the first parallel variable shunt
capacitance such that the second terminal of the series
transmission line provides a variable inductance;

whereby the second variable shunt capacitance is transformed into a variable inductance by the series transmission line and group delay is adjusted.

21. A method of providing group delay adjustment

5 comprising:

setting a first control voltage to a first value;
adjusting a second control voltage to produce a
predetermined insertion loss flatness;

measure a phase at a low frequency;
10 measure the phase at a high frequency;
calculate the group delay; and
record the first control voltage, the second control
voltage values and group delay.

22. The method of providing group delay adjustment of

15 claim 21, further comprising:

incrementing the first control voltage from the first
value in a plurality of differential steps until a final
control voltage is achieved;

each step of the plurality of differential steps
20 includes the steps of adjusting the second control voltage
value until a best insertion loss flatness is achieved
while the first control voltage is fixed;

measure a phase at a lowest frequency;
measure the phase at a highest frequency;
25 calculate a group delay; and

record the first control voltage value, the second
control voltage value and the group delay.

23. A method of providing group delay adjustment of claim 22 further comprising:

5 calculating an inverse first control voltage and an inverse second control voltage functions based on a first and a second control voltage and group delay accumulated data, to provide a first and a second control voltage for a given desired group delay within range of group delay adjustment range;

10 storing the group delay to produce the first and the second control voltage functions in a digital to analog converter; and

providing digital to analog conversion wherein group delay to first and second control voltage functions
15 provides on demand command conversion from a digital word to a first and a second control voltage setting to provide a desired group delay setting.

24. A method of providing group delay adjustment of claim 23 further comprising providing digital to analog
20 conversion wherein group delay to first and second control voltage functions includes temperature compensation to maintain a desired group delay setting over a full operating temperature range.